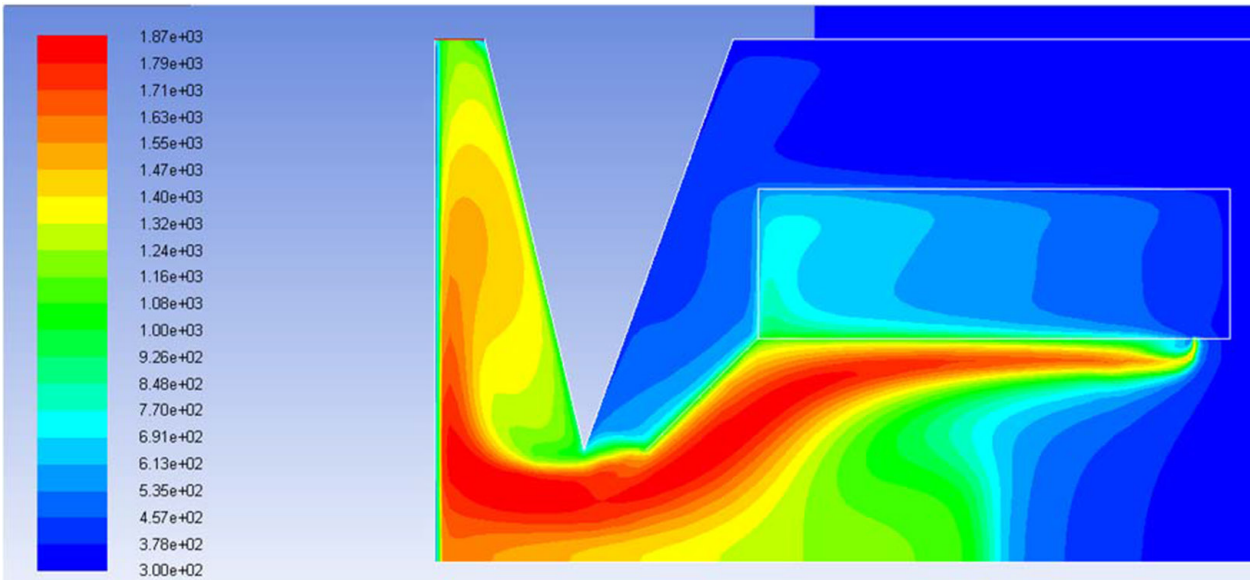
BIOCHAR COOKSTOVE DESIGN

By *ANSYS Advantage* Staff



Temperature contours in modified cookstove

A team of Cornell researchers — bringing together both faculty and graduate and undergraduate students — is developing a high-efficiency, low-emissions cookstove that also produces biochar, another term for charcoal, which improves soil productivity [1]. In developing countries, biomass cookstoves that burn fuel such as wood or corn cobs have long been the most common method of cooking and heating. But air pollution from cookstoves and open-fire cooking is a major world health problem. Cookstove inefficiency means that wood resources are not efficiently utilized, thus increasing deforestation.

ANSYS Fluent has been used extensively during the design process. For example, an early design of the stove was not performing as required because smoke was coming out of air inlets. Undergrad students modeled the stove in Fluent, numerically reproduced the backward-flow problem, and gained understanding of the root cause of this issue. The stove design consists of a series of concentric cylinders. The central cylinder is used for pyrolysis, converting biomass into charcoal in a low-oxygen environment. The next larger cylinder is the combustion chamber where biomass is loaded and burned. "An undergrad student came up with the idea of putting a cone on top of the pyrolysis chamber to guide the main flow inwards," says Elizabeth Fisher, associate professor in the Department of Aerospace and Mechanical Engineering at Cornell. "Simulation showed that smoke stopped escaping if the cone was added, and physical testing validated the new design."

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Learning Experience
ANSYS and Cornell University have developed a unique collaboration that has flourished for well over a decade, helping to extend Cornell's reputation as one of the world's leading research institutions. ANSYS software is used by students and teachers in the classroom as well as by project teams and researchers to solve challenging mechanical and fluid-flow problems.

Reference

[1] Torres-Rojas, D.; Lehmann, J.; Hobbs, P.; Joseph, S.; Neufeldt, H. Biomass Availability, Energy Consumption and Biochar Production in Rural Households of Western Kenya. *Biomass and Bioenergy*, **2011**, Vol.35, Issue.8, pp. 3537–46.